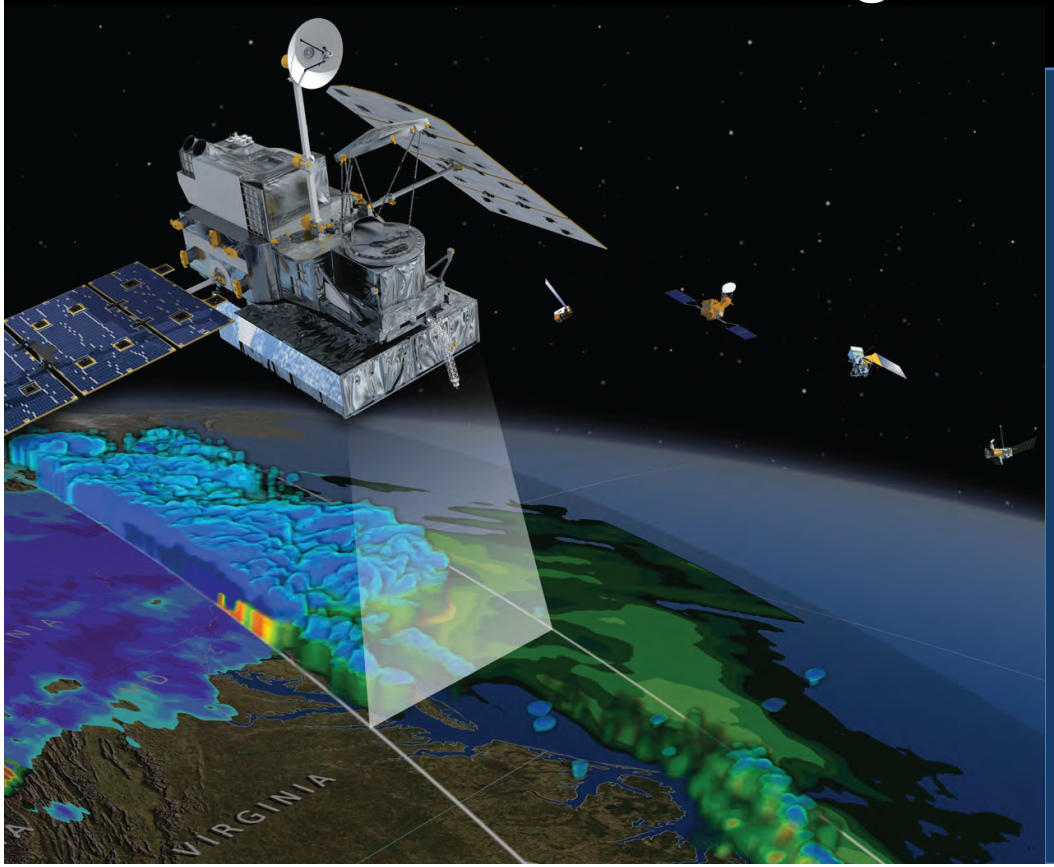
NASA HQ PMM Welcome and Program Status



Gail Skofronick-Jackson
PMM Program Scientist
NASA Headquarters
Gail.S.Jackson@nasa.gov

PMM Science Team Meeting
October 8-12, 2018
Phoenix, AZ

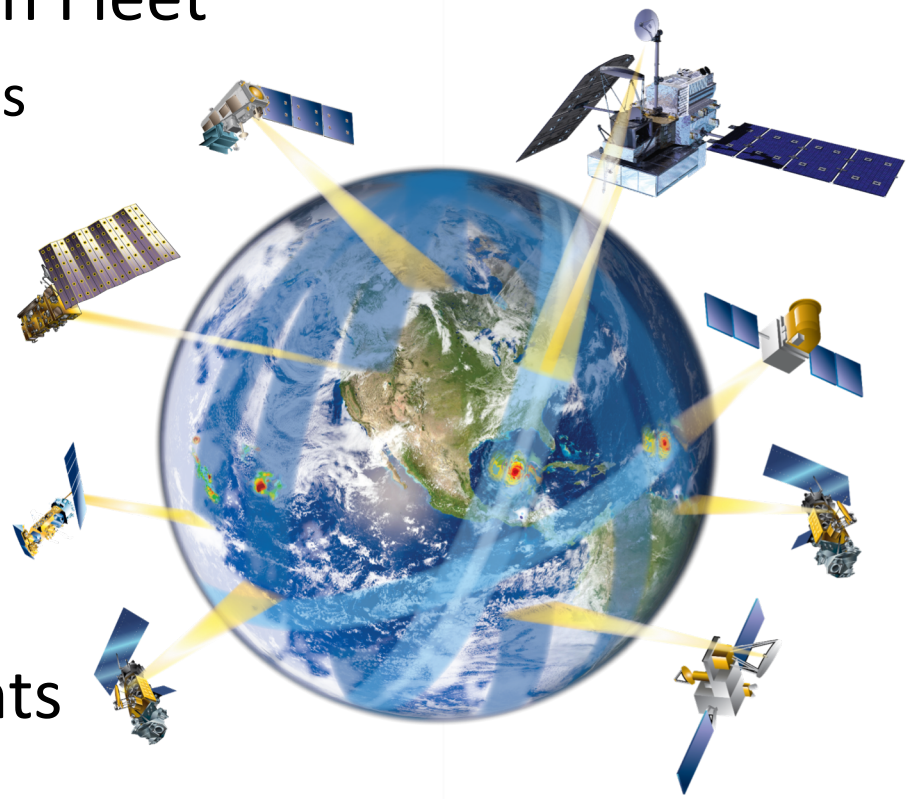
Ramesh Kakar Retires!!!!!

- Dedicating the Poster Session today (Tuesday) to Ramesh
  - Toast at 5:45pm
  - Happy hour 5:30-7:30pm

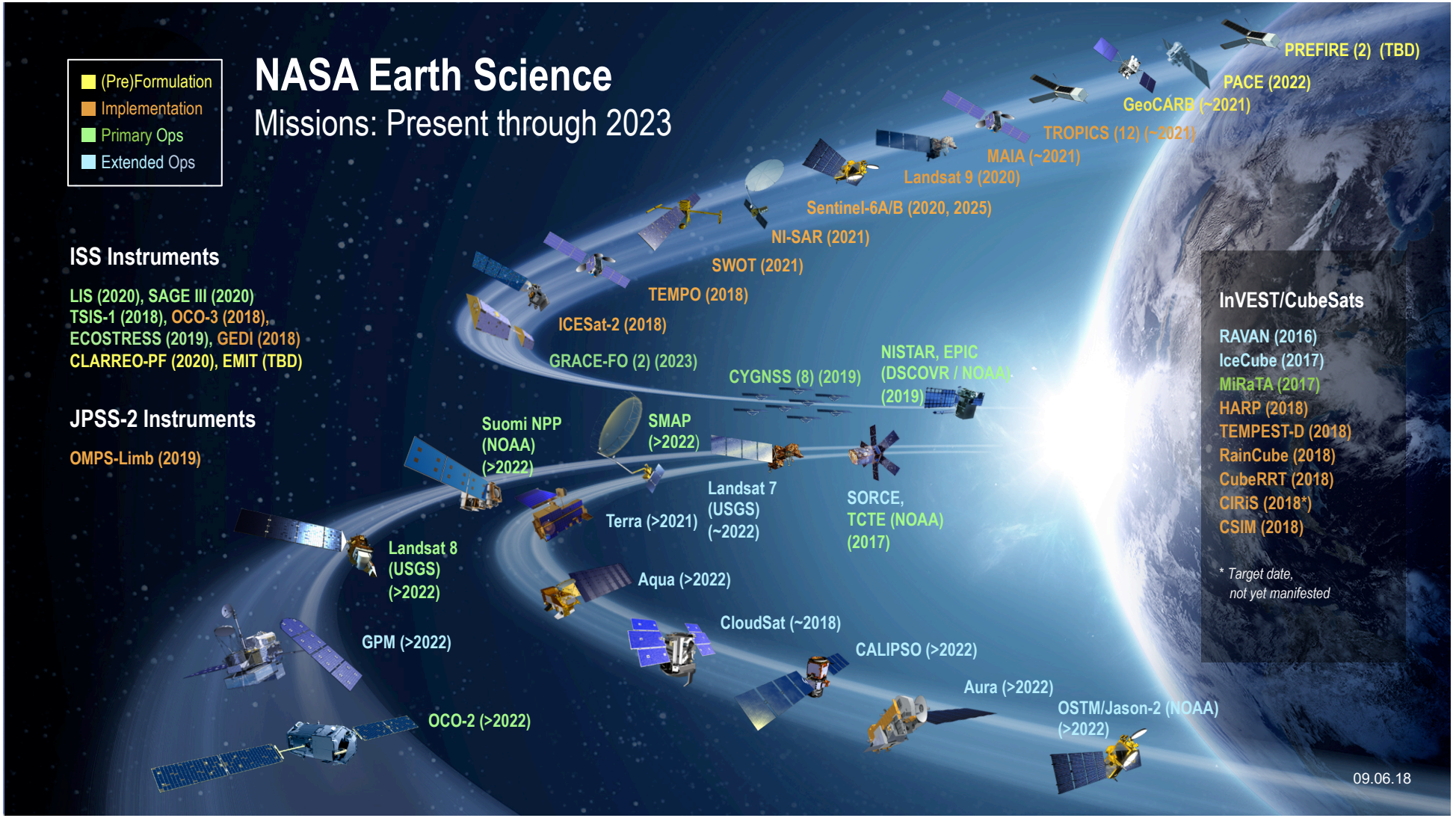
GLOBAL PRECIPITATION MEASUREMENT

Presentation Outline

- NASA Earth Science Division Fleet
  - Recent launches & first lights
- Decadal Survey
- GPM Status
  - GPM Core Observatory
  - Science status
  - ROSES status
- Noteworthy announcements

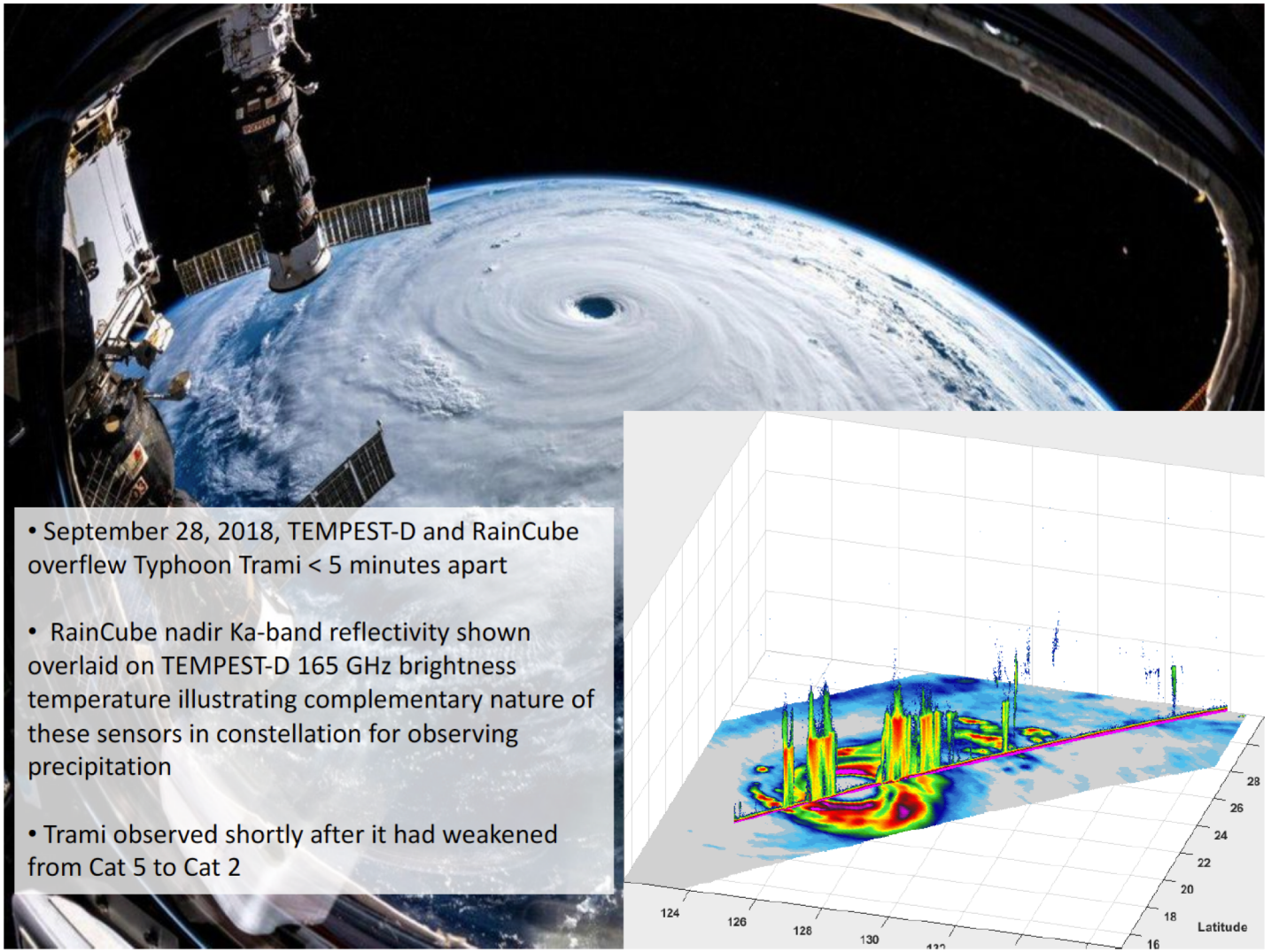


GLOBAL PRECIPITATION MEASUREMENT


(Pre)Formulation
Implementation
Primary Ops
Extended Ops
NASA Earth Science
Missions: Present through 2023
ISS Instruments
LIS (2020), SAGE III (2020)
TSIS-1 (2018), OCO-3 (2018),
ECOSTRESS (2019), GEDI (2018)
CLARREO-PF (2020), EMIT (TBD)
JPSS-2 Instruments
OMPS-Limb (2019)
PREFIRE (2) (TBD)
PACE (2022)
GeoCARB (~2021)
TROPICS (12) (~2021)
MAIA (~2021)
Landsat 9 (2020)
Sentinel-6A/B (2020, 2025)
NI-SAR (2021)
SWOT (2021)
TEMPO (2018)
ICESat-2 (2018)
GRACE-FO (2) (2023)
CYGNSS (8) (2019)
NISTAR, EPIC
(DSCOVR / NOAA)
(2019)
Suomi NPP
(NOAA)
(>2022)
SMAP
(>2022)
Landsat 7
(USGS)
(~2022)
SORCE,
TCTE (NOAA)
(2017)
Terra (>2021)
Landsat 8
(USGS)
(>2022)
Aqua (>2022)
CloudSat (~2018)
CALIPSO (>2022)
GPM (>2022)
Aura (>2022)
OSTM/Jason-2 (NOAA)
(>2022)
OCO-2 (>2022)
InVEST/CubeSats
RAVAN (2016)
IceCube (2017)
MiRaTA (2017)
HARP (2018)
TEMPEST-D (2018)
RainCube (2018)
CubeRRT (2018)
CIRiS (2018*)
CSIM (2018)
* Target date,
not yet manifested
09.06.18

TEMPEST-D and RainCube Observe Typhoon Trami

TEMPEST-D and RainCube teams

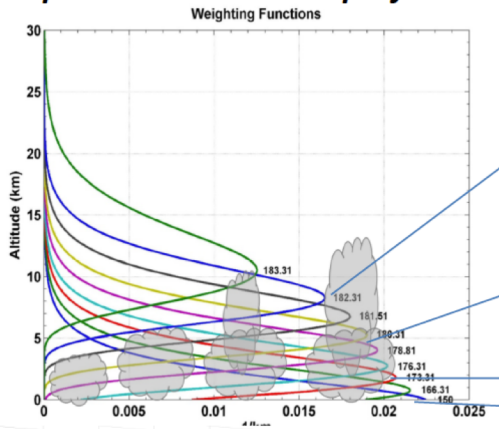


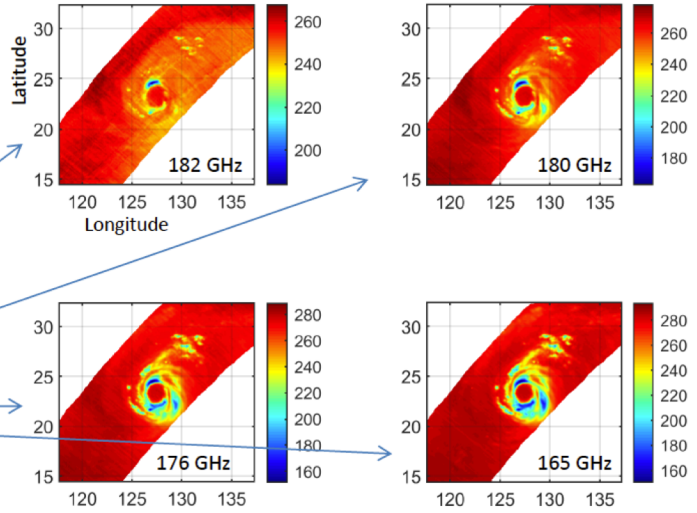
- September 28, 2018, TEMPEST-D and RainCube overflew Typhoon Trami < 5 minutes apart

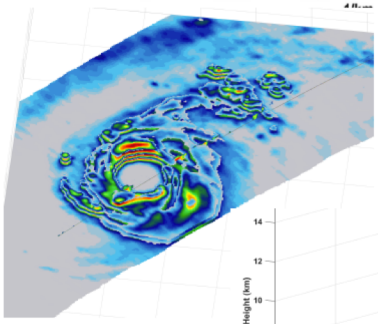
- RainCube nadir Ka-band reflectivity shown overlaid on TEMPEST-D 165 GHz brightness temperature illustrating complementary nature of these sensors in constellation for observing precipitation

- Trami observed shortly after it had weakened from Cat 5 to Cat 2

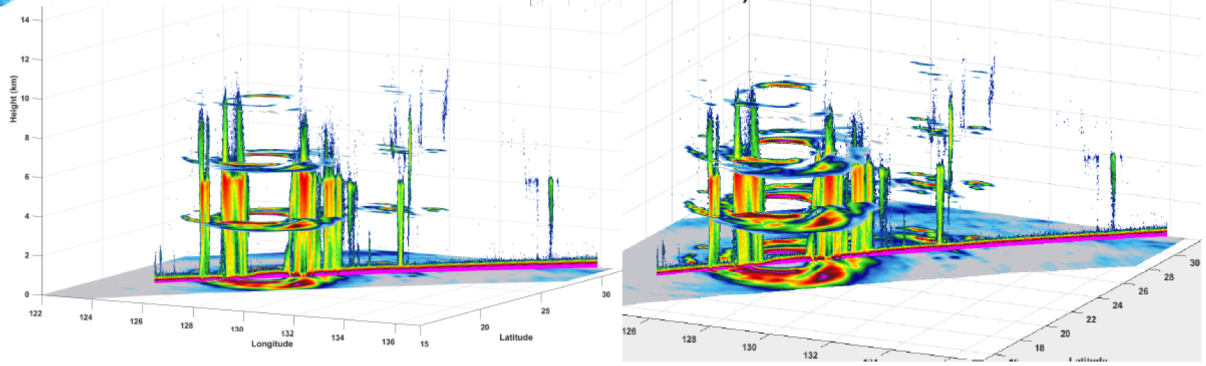
TEMPEST-D Sounding Channels provide 4 levels of vertical resolution to "slice" precipitation and compare with RainCube profile







Similar asymmetry observed in depth of eyewall convection between TEMPEST-D and RainCube (strongest on west side and to the south)



NASA Earth Science Decadal Survey Report; Released 5 Jan 2018

(https://www.nap.edu/catalog/24938/thriving-on-our-changing-planet-a-decadal-strategy-for-earth)

Recommended NASA Flight Program Elements (NASA HQ can adjust)

- ***Designated.*** A new program element for ESAS-designated cost-capped medium- and large-size missions to address ***observables essential to the overall program*** and that are outside the scope of other opportunities in many cases. Can be competed, at NASA discretion.

  → Aerosols; Clouds, Convection, and Precipitation; Mass Change; Surface Biology and Geology; Surface Deformation and Change

- ***Earth System Explorer.*** A new program element involving competitive opportunities for medium-size instruments and missions serving specified ESAS-priority observations. ***Promotes competition among priorities.***

  → 3 of 7 to be selected
  Greenhouse gases; Ice elevation; Ocean Surface winds and currents; Ozone and trace gases; Snow depth and snow water equivalent; Terrestrial ecosystem structure; Atmospheric winds

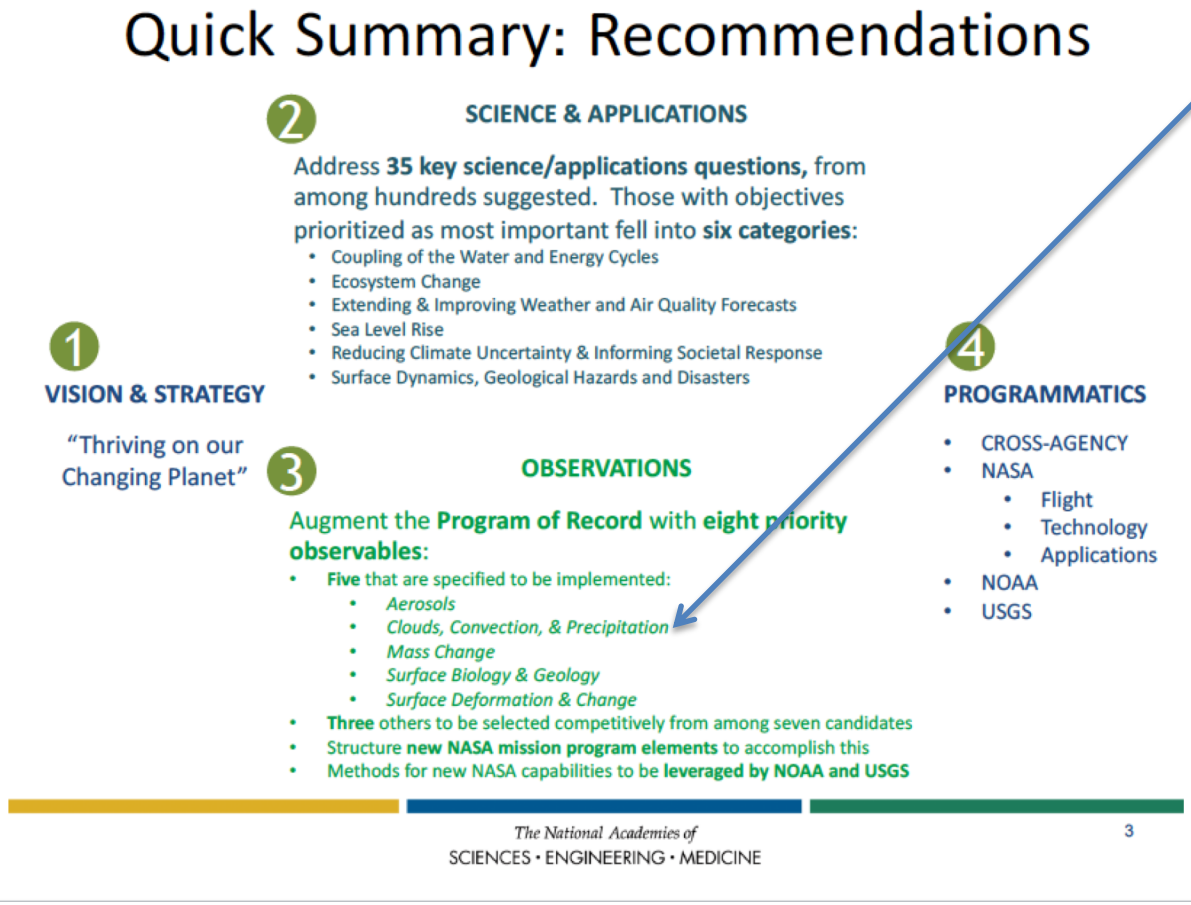
- ***Incubation.*** A new program element, focused on investment for priority observation opportunities needing advancement prior to cost-effective implementation, including an Innovation Fund to respond to emerging needs. ***Investment in innovation for the future.***

- ***Venture.*** Earth Venture program element, as recommended in ESAS 2007 with the addition of a new Venture-Continuity component to provide ***opportunity for low-cost sustained observations.***

  → Planetary boundary layer; Surface topography and vegetation

NASA Earth Science Decadal Survey Report; Released 5 Jan 2018

(https://www.nap.edu/catalog/24938/thriving-on-our-changing-planet-a-decadal-strategy-for-earth)

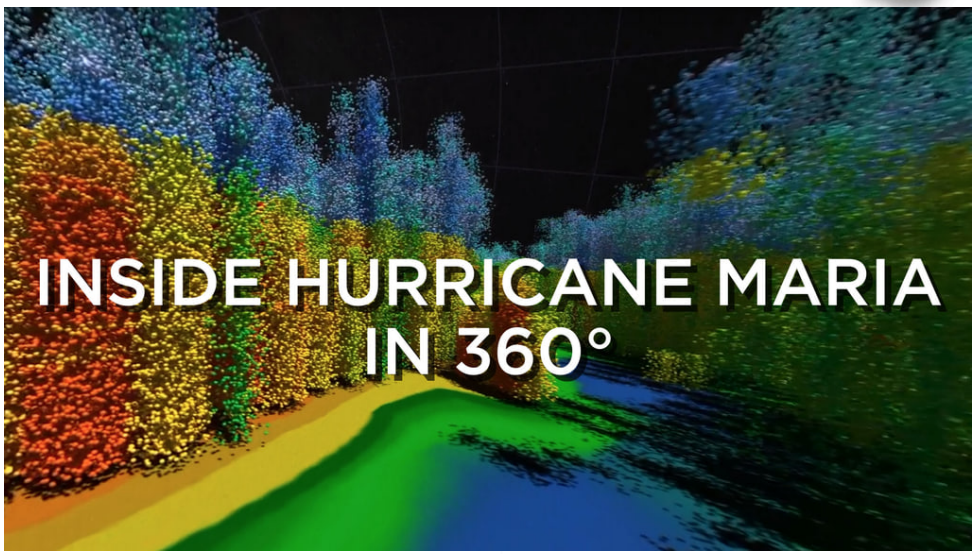


- Clouds, Convection, & Precipitation
- See Scott's presentation at the end of today

GPM Core Observatory: 4 years, 7 months, and ~9 days old

GPM Data is being used operationally

- by National Hurricane Center
  - GMI TB
- by FEMA (H. Florence)
  - Adler/Gu's Flood maps
    - Forecast of flood event location/intensity
    - Inundation estimates at 1 km resolution



https://svs.gsfc.nasa.gov/13079

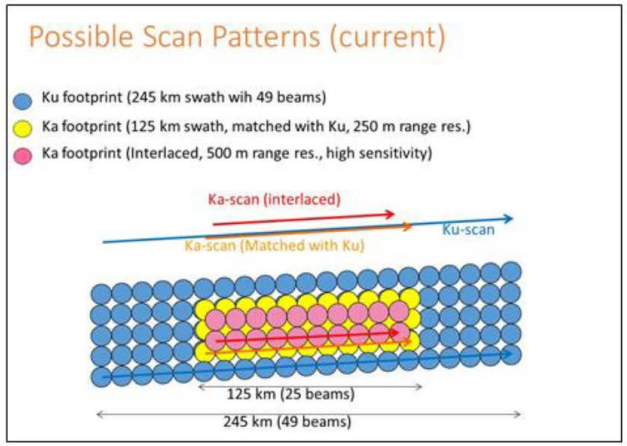
Phase F report (for end of operations)

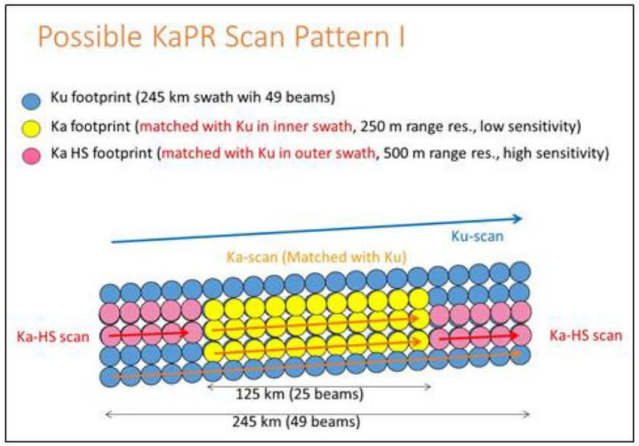
- Submitted June 2018
- 3 year plan requested

May plan a 5th year anniversary symposium

DPR Operations Change in May 2018

KaPR's scan pattern change (KaPR only)





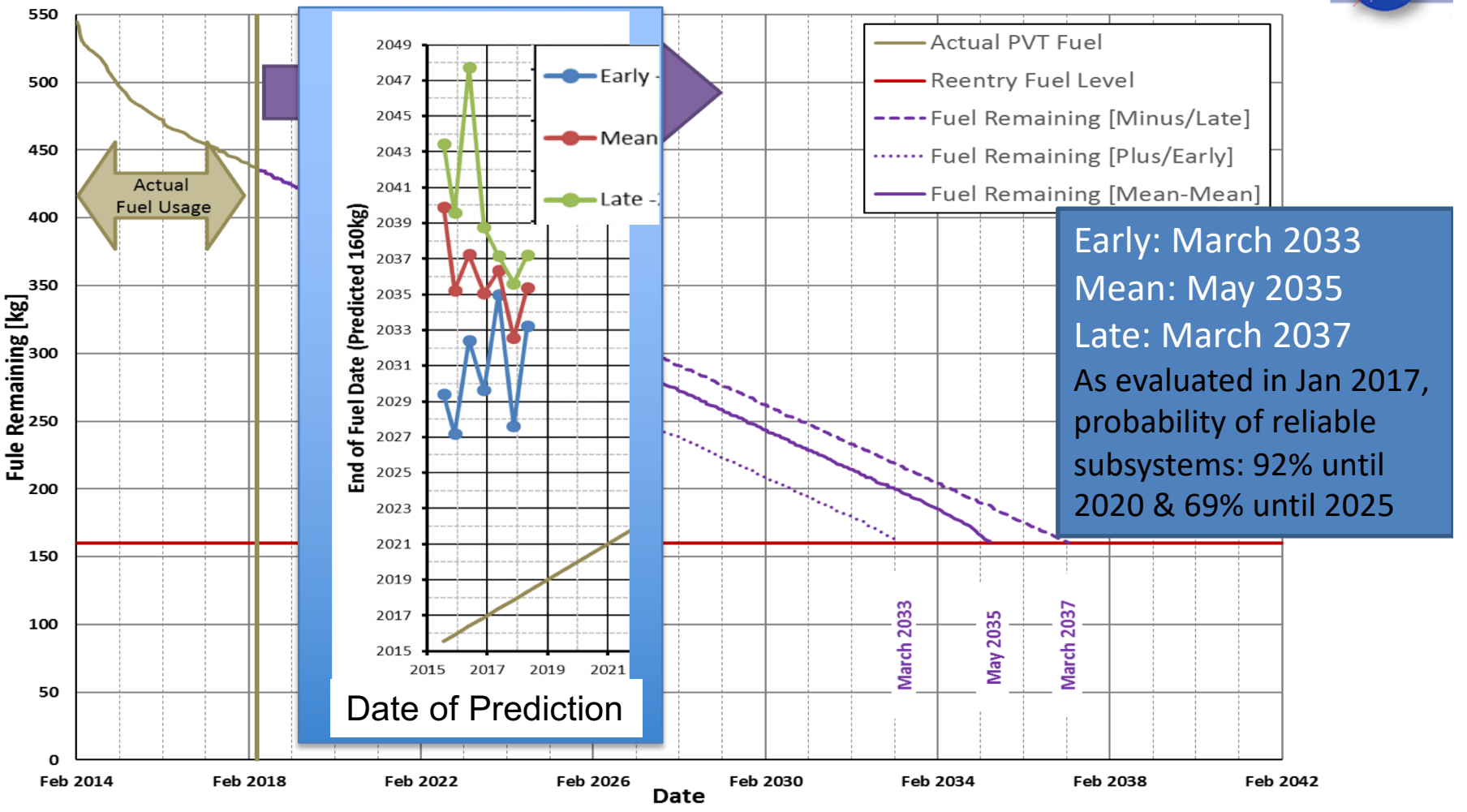
Major changes (item A):

- KaPR-HS's scan pattern will be changed.
  → Dual-frequency technique will be applied in a full swath.

Minor changes (item B):

- Scan angle of KaPR-MS scan will be changed to realize improvement of beam matching between KuPR and KaPR (by a request from the DPR-L2 algorithm team).

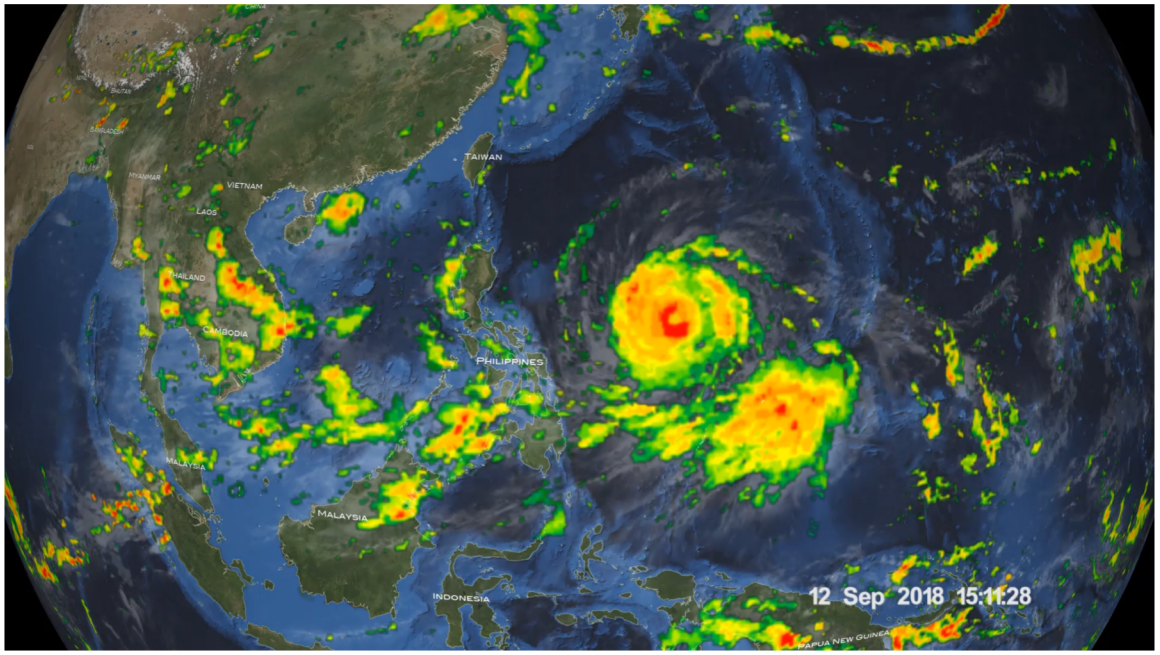
May 2018 Fuel Estimates



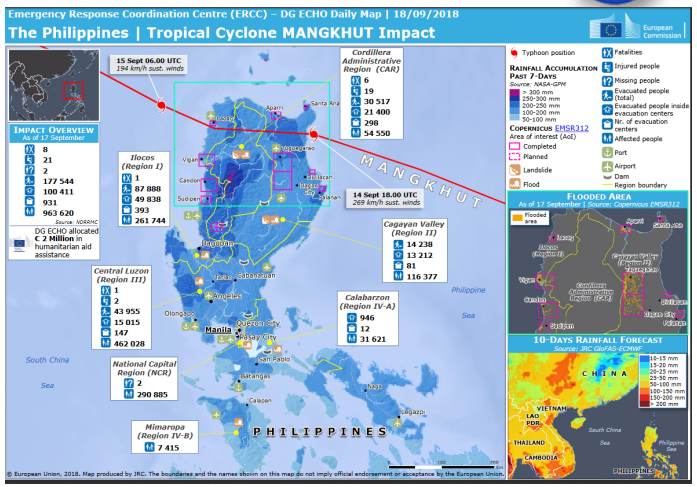
Early: March 2033
Mean: May 2035
Late: March 2037
As evaluated in Jan 2017, probability of reliable subsystems: 92% until 2020 & 69% until 2025

Typhoon Mangkhut, September 13th, 2018

The GPM Core Observatory passed over Typhoon Mangkhut on Sept. 13th as it was a powerful Category 5 super typhoon. Torrential rains and strong winds impacted the Philippines, China, and Hong Kong. GPM IMERG data was used by the European Commission to show accumulated rainfall as the storm traced across the Philippines (right). The *New York Times* also highlighted the storm's intensity using a series of GPM graphics (below, right).

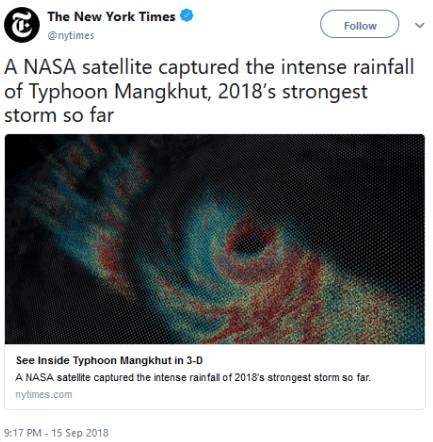


https://svs.gsfc.nasa.gov/4682



Credit: https://erccportal.jrc.ec.europa.eu/Maps/Daily-maps

The New York Times developed a storymap showing 3-D views of Typhoon Mangkhut on Sept 15th.



GPM Science Team

- NASA GPM Science team has **60** PI teams; New selections expected Dec 2018
- NASA has **22** no-cost International PI teams; International PI/team Proposals always welcome


NASA Precipitation Measurement Mission Science Team Meeting, San Diego, CA USA October 2017

- Argentina (U. Buenos Aires)
- Australia (BOM)
- Austria (U. Graz)
- Belgium (KUL–Antarctica)
- Brazil (INPE)
- Brazil (CPTEC)
- Canada (EC)
- Colombia (U. Nacional de Colombia)
- Cyprus (CMS)
- Finland (FMI, U. Helsinki)
- France (CNRS and partners)
- Germany (U. Bonn)
- HSAF (7 countries, Italy-Leads)
- Israel (Hebrew U. Jerusalem)
- Italy (CNR-ISAC)
- Japan
- Netherlands (RNMI)
- South Korea (KMA)
- Spain (UCLM)
- Sweden (Lund University)
- Switzerland (EPFL)
- United Kingdom (U. Birmingham)

NASA Center Work Package Support

NASA implemented a Work Package Internal Scientist Funding Model (ISFM) at NASA Centers during FY18.

Under ISFM, NASA Center scientists are covered for a portion of their time for FY19, FY20, & FY21.

Cecil, Daniel (MSFC)	Better Understanding GPM Radiometer Measurements Using Ground-Based Radar
Huffman, George (GSFC)	Extending the IMERG Multi-Sensor Level 3 Precipitation Product into Polar Regions
Meneghini, Robert (GSFC)	Path Attenuation Estimates from the Dual-Frequency Precipitation Radar
Munchak, Stephen (GSFC)	Improved Representation of Active and Passive Surface Characteristics in the GPM DPR-GMI Combined Precipitation Algorithm
Olson, William (GSFC/JCET)	Continued Development and Validation of Ice- and Mixed-Phase Precipitation Models for the GPM Combined Radar-Radiometer Algorithm
Petersen, Walter (MSFC)	Validation of GPM Precipitation Retrieval Algorithms across the Precipitation Continuum
Peters-Lidard, Christa (GSFC)	Dynamic Emissivity Estimates to Support Physical Precipitation Retrievals for GPM (continued)
Tao, Wei-Kuo (GSFC)	Advancing the Retrieval of Latent Heating for PMM with Improved Simulations of Convective, Synoptic, and Cold Season Systems and their Associated Microphysical and Precip. Processes

10th PMM Science Team ROSES Call

- **Proposals Due: 28 June 2018**
- **Total of 130 proposals received****
- **Total Available Funding: ~5.3M***
- **Maximum Award Duration: 3 years (2019-2021, FY19-FY21)**
- **Total Number of Awards: TBD (advertised 40-50, expect 30-40 total*)**
- **Peer Review Panels:**
  - **No "mail-in" reviews**
  - **No PI or Co-I on the panels**
- **Selection Announcements: TBD (expected late 2018)**

*** Approximate total after the ISFM funds have been removed**

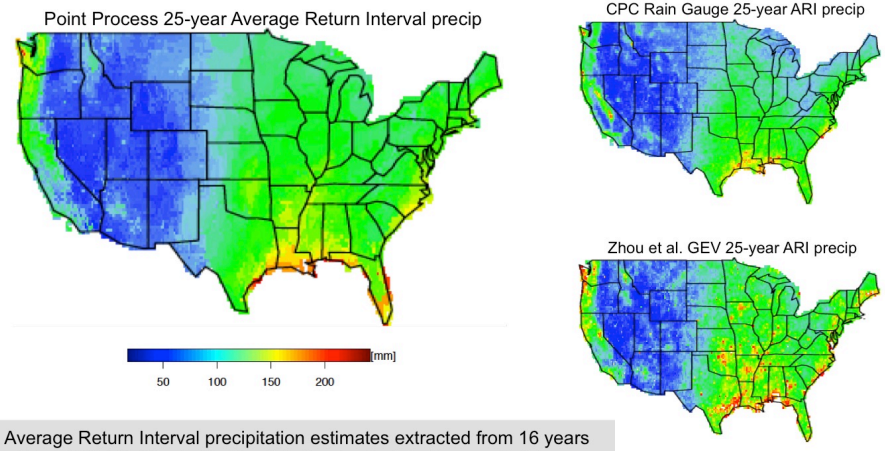
** It is expected that the Algs, Sci, Appl categories "…will receive approx. 40%-30%-30% respectively of the available funding, but the ***proportions may be adjusted according to the needs of the PMM program*** …"

Share your research & publications

- Send us science highlights and/or paper URL's with a brief summary

Making Better Estimates of Extreme Precipitation with TRMM Data

L. Demirdjian[1], Y. Zhou[2,3], G.J. Huffman[4]
[1]UCLA, [2]Morgan State Univ., [3]NASA/GSFC 613, [4]NASA/GSFC 612



Average Return Interval precipitation estimates extracted from 16 years of the TRMM Multi-satellite Precipitation Analysis in the new Point Process analysis are closer to the 65-year NOAA/Climate Prediction Center rain gauge map than the values produced by the previous Zhou et al. Generalized Extreme Value analysis.

Earth Sciences Division - Atmospheres

Name: George J. Huffman, NASA/GSFC Code 612
E-mail: george.j.huffman@nasa.gov
Phone: 301-614-6308

References:

Demirdjian, L., Y. Zhou, G.J. Huffman, 2017: Statistical Modeling of Extreme Precipitation with TRMM Data. *Journal of Applied Meteorology and Climatology*, in revision, doi: pending.

Data Sources: Version 7 TRMM Multi-satellite Precipitation Analysis (TMPA; using precipitation estimates from Aqua, DMSP, METOP, NOAA, and TRMM satellites, and the Global Precipitation Climatology Centre monthly precipitation gauge analyses), and NOAA/Climate Prediction Center (CPC) Average Return Interval (ARI) maps. Support was provided by a Burroughs Wellcome Fund Population and Laboratory Based Sciences Award at UCLA, the NASA/GSFC internship program, NASA PMM, and NASA Terra/Aqua.

Technical Description of Figures:
The new Point Process (PP) statistical model was developed to address perceived issues in the initial Zhou et al. (2015) extreme value analysis. That study fitted a Generalized Extreme Value (GEV) probability distribution to the set of annual maximum daily precipitation accumulations that TMPA provided in each latitude/longitude grid box separately. This approach gave relatively noisy estimates for ARIs longer than the 16-year data record (lower right) when compared to the NOAA/CPC analysis of daily precipitation gauge data (upper right). [The CPC analysis uses 65 years of data over some 8,000+ stations, and is considered the standard of comparison.] In the new study, the entire domain was partitioned into clusters of about 30 gridboxes based on the 90th percentile daily precipitation, and then event-maximum daily values (for days exceeding the 99th percentile) were pooled. A PP analysis was used to create fitted extreme parameters for each cluster. The PP results are relatively smooth and close to the NOAA/CPC analysis. Despite a better overall pattern, the PP generally gives somewhat higher values than the CPC in the eastern half of the country.

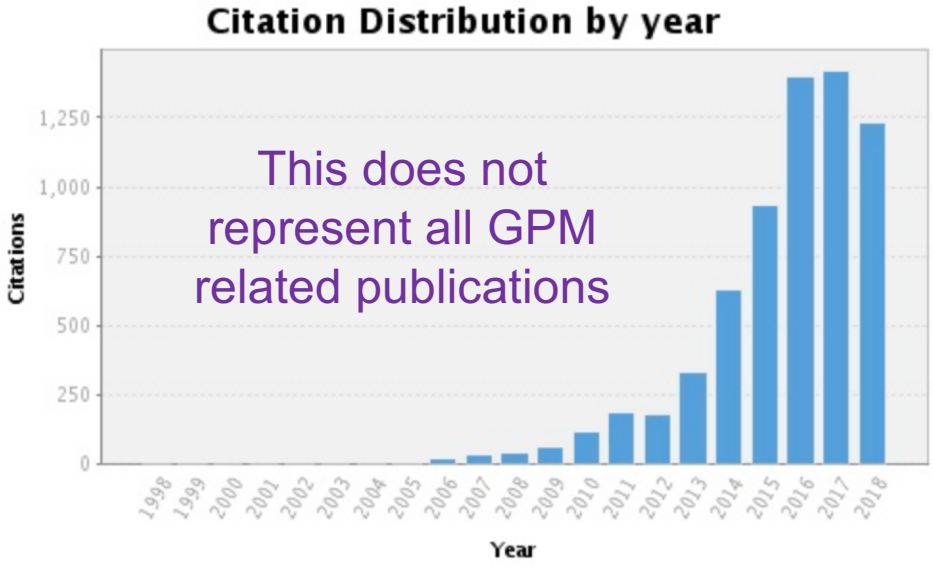
As well, a version of the PP was created to account for the seasonal cycle so that it is possible to evaluate events in the context of "typical" for the time of year. [The previous study lacked this capability.] The eastern part of the U.S. showed a relatively modest seasonal cycle in ARI values, but the Southwest, and California, in particular, showed strong seasonality, as expected.

Scientific significance, societal relevance, and relationships to future missions: Although demonstrated here just for the Coterminous United States, the analysis has been performed for the entire latitude belt 50°N-S, providing extreme value estimates for all areas, land and ocean, without regard to the density of surface observations. The new estimation approach makes much better use of the available short record of satellite data, giving much more confidence in the values provided. Such information is critical for for scientifically and practically evaluating current and previous precipitation events. As well, it supports the definition of design standards for infrastructure, including siting buildings, laying out transportation grids, and sizing water management projects. When the new Integrated Multi-satellitE Retrievals for Global Precipitation Measurement (GPM) mission (IMERG) datasets are extended to cover both the TRMM and GPM eras, this methodology will be directly applicable.

GLOBAL PRECIPITATION MEASUREMENT

Publication Status

- The AMS special collections on GPM:
  - GPM in general: 25 articles; Algs: 13 articles; IFloods: 15 articles
- Please send accepted GPM related publications (in any journal) to Lisa Nalborczyk for inclusion on the GPM webpage listing
  - https://pmm.nasa.gov/resources/gpm-publications



Total Articles in Publication List: **336**

Articles With Citation Data: **303**

Sum of the Times Cited: **6600**

Average Citations per Article: **21.85**

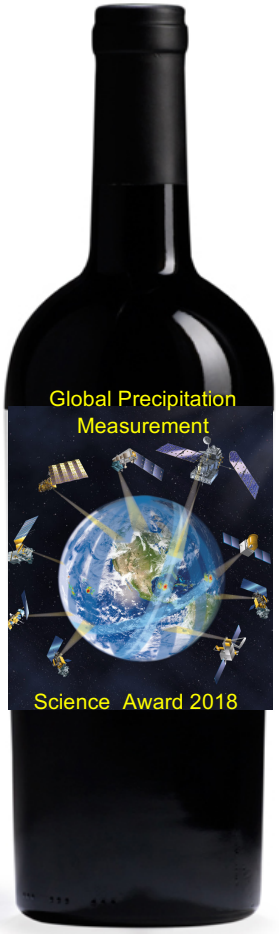
h-index: **41**

Last Updated: **10/09/2018 02:12 GMT**

Noteworthy Announcements

- Congrats to Scott Braun, George Huffman, and Zhaoxia Pu as new AMS Fellows
- Congrats to Christa Peters-Lidard & Fuqing Zhang as new AGU Fellows
- Congrats to Dennis P. Lettenmaier for the AGU Robert E. Horton Medal
- Congrats to Lynn McMurdie and team for IMPACTS – recent EV-s selection (IMPACTS=Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms)
- Anyone else?

Today's Science Team Award



Arthur Hou's tradition: Award WG/team that improves algorithm performance using actual data

Gail's Update: Award Person(s) or Team(s) that significantly enhance PMM science

2018 Award Winners: Jackson Tan

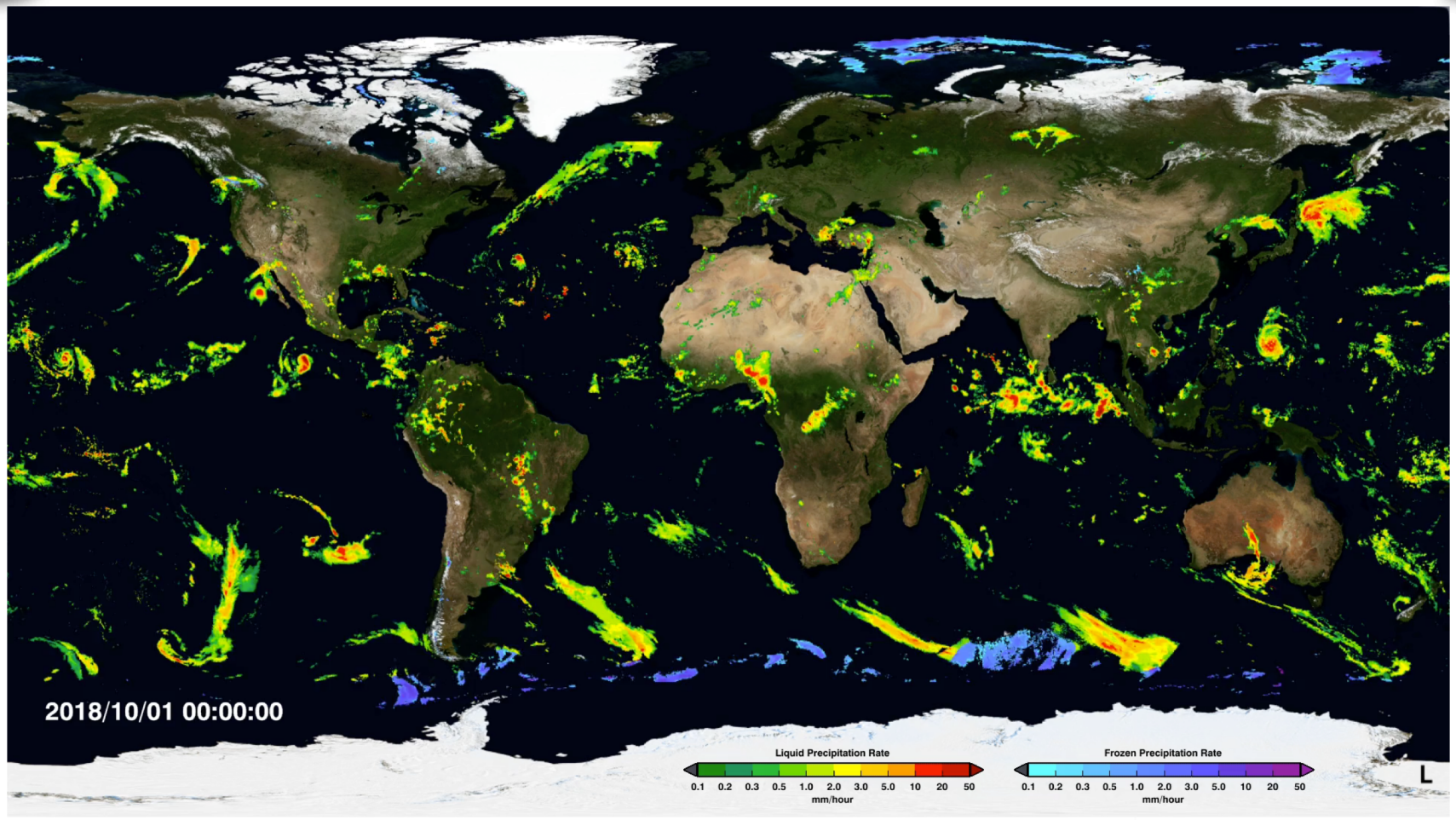
Citation: For developing a practical approach using numerical analyses and forecasts to estimate the motions of precipitation systems for IMERG and leading to a pole-to-pole solution.

GLOBAL PRECIPITATION MEASUREMENT

2018 Award Winners: Min-Jeong Kim

Citation: For successful implementation of real-time all-sky GMI assimilation into the operationally run GEOS-5 global model

Questions?


2018/10/01 00:00:00
Liquid Precipitation Rate
0.1 0.2 0.3 0.5 1.0 2.0 3.0 5.0 10 20 50
mm/hour
Frozen Precipitation Rate
0.1 0.2 0.3 0.5 1.0 2.0 3.0 5.0 10 20 50
mm/hour
L